

NOT FOR PUBLICATION

**UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY**

MATSUSHITA ELECTRIC INDUSTRIAL
CO., LTD., : Plaintiff, : Civ. No. 02-336 (GEB)
v. : :
SAMSUNG ELECTRONICS CO., LTD., : :
et al., : Defendants. :
SAMSUNG ELECTRONICS CO., LTD., : :
et al., : Counterclaimants, :
v. : :
MATSUSHITA ELECTRIC INDUSTRIAL
CO., LTD., : :
Counterclaim Defendant. :

BROWN, C.J.:

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INTRODUCTION

This matter comes before the Court upon the parties' request for claim construction in this patent infringement action. On January 25, 2002, Plaintiff Matsushita Electric Industrial ("MEI") brought suit against Samsung Electronics Co., Ltd. and its affiliates (collectively referred to as "Samsung") for infringement of three of their patents concerning semiconductor technology.¹ In particular, MEI asserts that Samsung's products infringe U.S. Patent No. 5,053,998 ("the '998 Patent"), U.S. Patent No. 5,375,095 ("the '095 Patent), and U.S. Patent No. 5,475,648 ("the '648 Patent") (collectively referred to as "the MEI Patents"). Samsung counterclaimed alleging infringement of five of its patents relating to the same field of technology by MEI and some of its affiliates. Since then, four of the counterclaim patents have been withdrawn or dismissed, and only one counterclaim patent remains – U.S. Patent No. 5,751,048 ("the '048 Patent").

On March 7, 2005, the parties filed their Opening Claim Construction briefs with the Court. Thereafter, the parties submitted opposition briefs on April 11, 2005 and reply briefs on May 2, 2005. In their submissions, the parties included Joint Claim Construction Charts which identified the disputed claim terms, as well as stipulated constructions. (Certification of Michael V. Solomita, Ex. 4 ("MEI Patents Chart"); Certification of Gregory M. Hasley, Ex. 17 ("Samsung Patent Chart)). On January 19 and 20, 2006, the parties presented a tutorial on the relevant technology. The Court conducted a *Markman* hearing on February 9 and 10, 2006.²

¹ The case was initially assigned to the Newark vicinage. On December 6, 2005, the matter was reassigned to Chief Judge Garrett E. Brown, Jr. in Trenton.

² On January 27, 2006, Samsung filed a motion to seal certain confidential documents in connection with supplemental exhibits in support of Samsung's claim construction briefs. As discussed at the hearing on February 9, 2006, this Court did not grant Samsung leave to file supplemental exhibits during the technology tutorial on January 31, 2006. The instant motions

BACKGROUND

The subject matter of the four patents-in-suit relates to semiconductor memory devices. Dynamic random access memory, or DRAM, is an example of such a memory device. DRAMs have become one of the key products in the semiconductor industry. They allow for temporary storage of information that can quickly be accessed and recalled by a computer.³ DRAMs are capable of storing over 250 million bits of information on an individual semiconductor chip which typically can be as small as three-quarters of a square inch. With the increasing demand for faster computers and other electronic devices, efforts are consistently being made to increase the memory capacity and access speed of an individual memory device. Currently, DRAM chips that can store over 1 billion bits of information are in the early stages of development and production.

DRAMs typically consist of millions to billions of memory cells arranged in a two-dimensional array of rows and columns. Given this arrangement, each memory cell has a unique address based on the row and column of the matrix. The memory cell is composed of a capacitor, which stores electric charges, and a transistor, which allows for the release of these charges. On the vertical axis of an array, rows are formed by small wires known as word lines which are connected to the transistors of the memory cell. On the horizontal axis of an array, columns are formed by small wires known as data lines or bit lines which connect the capacitors of the memory cells. When

for claim construction have been fully briefed since May 2005, and the Court does not find a proper basis for receiving belated filings at this time. As stated at the *Markman* hearing, however, the Court will allow the supplemental filing of the prosecution histories for the '998, '095 and the '648 Patents, to which MEI does not object. Consequently, Samsung's motion to seal is denied as they do not pertain to the prosecution histories of these patents.

³ See Matsushita's Br. In Supp. of Its Claim Construction of the Matsushita Patents ("MEI's Br.") at 8-10; see also Samsung's Substituted Opp'n *Markman* Br. for the Matsushita Patents ("Samsung's Opp'n") at 2 n.3).

the central processing unit (“CPU”) of a computer communicates with the DRAM chip to access and retrieve information, the CPU designates the unique address of the memory cell from which it wishes to retrieve the data.

Memory cells store information in the form of binary code, i.e., zeros and ones. In semiconductors, the binary value of zero or one is represented by an electrical signal or charge which is stored in the capacitor of the memory cell. For example, a binary value of one can be represented by a high charge and a binary value of zero can have either a low charge, or no charge at all. The process of retrieving binary values from memory cells is referred to as reading. Generally in a data read-out operation, a row address signal is sent to and decoded by the row decoder. ‘998 Patent, col. 1, ll. 19-36. The row decoder sends the decoded address to the word line driver which uses this information to activate the word line that corresponds to the row address. The electrical signals contained in the individual memory cells, which are connected to the activated word line, are transferred onto the bit lines.

These signals, however, are extremely small – so small that they cannot be understood by the rest of the DRAM components in that state. A sense amplifier is required to amplify, or strengthen, the signals so that they may be read as a zero or one. Additional circuitry involving differential amplifiers, sense amplifier drivers, and restore and drive signal lines act together to amplify the signals. These amplified signals are then sent to a data selector. The desired information in the data selector is transmitted to the data output buffer once the column address is determined by the column address buffer and column decoder.

DISCUSSION

I. Law of Claim Construction

The first step in a patent infringement analysis is to define the meaning and scope of the claims of the patent. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370 (1996). Claim construction, which serves this purpose, is a matter of law exclusively for the court. *Id.* at 979. The Federal Circuit recently clarified the proper methodology for claim construction in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). The court stated that the claims of a patent serve as the proper starting point, noting the "bedrock principle of patent law that the claims of a patent define the invention to which the patentee is entitled the right to exclude." *Id.* at 1312 (citing *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004) (quotations omitted)). The court articulated that words should generally be given their ordinary and customary meaning – particularly from the vantage point of a person of ordinary skill in the art. *Phillips*, 415 F.3d at 1313. This provides an objective baseline from which claim construction should begin. *Id.*

Significantly, the Federal Circuit further noted that a "person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id.* In attempting to discern the meaning of claim terms, the court identified various sources from which the proper meaning may be determined. The claim in which the term appears and other claims of a patent, including both asserted and unasserted claims, can serve as "valuable sources of enlightenment as to the meaning of the claim term." *Id.* at 1314.

The court also emphasized the primacy of the specification in a claim construction analysis,

noting that it is usually dispositive and “the single best guide to the meaning of a disputed term.” *Id.* at 1315. The specification may reveal whether the patentee acted as his own lexicographer by importing a special definition to the claim term – in which case, the patentee’s lexicography governs. *Id.* at 1316. Moreover, the specification can further reveal any intentional disavowal or disclaimer of claim scope. In such instances, “the inventor has dictated the correct claim scope, and the inventor’s intention, as expressed in the specification, is regarded as dispositive.” *Id.*

The prosecution history should also be taken into consideration if in evidence. Consisting of the complete record of the Patent and Trademark Office (“PTO”) proceedings, “the prosecution history provides evidence of how the PTO and the inventor understood the patent.” *Id.* at 1317. Unlike the specification, however, which represents the final product of ongoing negotiations between the PTO and the patentee, the prosecution history may lack clarity and serve as a less helpful tool in claim construction. *Id.* Nonetheless, this part of the intrinsic evidence “can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be.” *Id.*

The Federal Circuit cautioned against the use of extrinsic evidence during claim construction since this type of evidence suffers from certain inherent flaws which affect its reliability in a claim construction analysis. This class of evidence includes “all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises.” *Id.* at 1317 (quoting *Markman*, 52 F.3d at 980). Although extrinsic evidence may be useful, “it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence.” *Id.* at 1319. A court nonetheless is permitted to admit and use extrinsic

evidence in its sound discretion, so long as the court remains mindful of the inherent flaws in this type of evidence and considers it accordingly. *Id.*

Phillips also clarified the role of dictionaries in claim construction. Placing undue reliance on dictionaries would improperly focus “the inquiry on the abstract meaning of words rather than on the meaning of claim terms within the context of the patent.” *Id.* at 1321. The “ordinary meaning” of the claim term is properly viewed as the “meaning to the ordinary artisan after reading the entire patent.” *Id.* Moreover, dictionaries are naturally suspect as they “provide an expansive array of definitions” and often collect all uses of a word “from the common to the obscure.” *Id.* This may result in extending “patent protection beyond what should properly be afforded by the inventor’s patent.” *Id.* at 1322. Despite such concerns, however, courts are not precluded from using dictionaries in the appropriate manner during claim construction analysis. *Id.*

Lastly, the court must be mindful of the well-settled rule “that while proper claim construction requires an examination of the written description and relevant prosecution history to determine the meaning of claim limitations, additional limitations may not be read into the claims.” *Storage Tech. Corp. v. Cisco Sys., Inc.*, 329 F.3d 823, 831 (Fed. Cir. 2003); see also *In re Donaldson Co.*, 16 F.3d 1189, 1195 (Fed. Cir. 1994) (noting the “general claim construction principle that limitations found only in the specification of a patent or patent application should not be imported or read into a claim.”).

II. The Disputed Claim Terms

A. The '998 Patent

The '998 Patent is entitled "Semiconductor Memory Device With Dual Drivers To Sense Amp Array." The '998 patent was issued on October 1, 1991 to Kannan, *et al.* The '998 Patent primarily concerns the part of the circuitry discussed above that is involved with the amplification of the electrical signals. The invention addresses certain problems that existed in the prior art with respect to the speed and stability of data transmission in the semiconductor memory device. These problems relate to the need to increase the number of memory cells in a DRAM in order to meet the demand for greater memory capacity and higher processing speeds. '998 Patent, col. 1, ll. 9-12. The addition of more memory cells resulted in greater chip size, the use of longer or narrower wires, and increased wiring resistance. *Id.*, col. 1, ll. 13-16.

The first objective of the invention is directed to the arrangement and operation of multiple sense amplifier drivers to counter increased wiring resistance and improve the speed of data transmission. '998 Patent, Abstract & col. 3, ll. 9-12. In the prior art, data in the form of voltages are transferred onto data lines that are connected to a plurality of differential amplifiers. *Id.*, col. 1, ll. 44-46 & Fig. 7. Each differential amplifier has a pair of control terminals – one attached to a restore signal line and the other attached to a drive signal line. *Id.*, col. 1, ll. 46-49. The restore and drive signal lines are connected to a sense amplifier driver which provides the necessary drive signals to activate the differential amplifiers contained within the sense amplifier. *Id.*, col. 1, ll. 55-58. Significantly, the reading operation cannot be completed until all of the differential amplifiers become activated. (Jan. 20, 2006 Certification of Erica S. Helms, Ex. A. at 4:1-2).

The inventors of the '998 Patent recognized that the increased wiring resistances associated

with the restore and drive signal lines caused delay in transmission of the restore and drive signals. More specifically, the signals would have to travel further distances in order to activate all of the differential amplifiers. To solve this problem, the patent teaches the placement of a second sense amplifier driver at the other end of the restore and drive signal lines, i.e., opposite the first amplifier driver. With the additional sense amplifier driver placed in this position, restore and drive signals required to turn on the differential amplifiers can be sent from the second sense amplifier driver in addition to the first. Thus, the signals originating from the first sense amplifier driver need only travel half the distance, thereby reducing the signal transmission time by half. The patent also teaches placing additional sense amplifier drivers within the plurality of differential amplifiers to further decrease wiring resistance and increase the speed of transmission.

In addition, the '998 Patent addresses a second problem that is created by this arrangement. Specifically, the simultaneous operation of a plurality of differential amplifiers causes a peak value of instantaneous current. *Id.*, col. 2, ll. 54-56. This sudden peak in current may result in errors and delay in data transmission. *Id.*, col. 2, ll. 56-64. Thus, a need existed to reduce or eliminate the instantaneous current during operation of the sense amplifier. *Id.*, col. 3, ll. 15-16. The invention sought to correct this problem by incorporating wiring resistances in the signal lines which results in delayed actuation of the second sense amplifier driver. With the differential amplifiers activated at different times, the peak instantaneous current is reduced. *Id.*, col. 4, ll. 30-56.

Based on the parties' written submissions, and as clarified at the *Markman* hearing, there are six disputed claim terms for construction. Claim 1 is a representative claim. It claims:

A semiconductor memory device comprising:

a memory cell array having a plurality of memory cells arranged in the form of a matrix;

a means for reading into a plurality of data lines data from a plurality of memory cells connected to a specific word line by activating said specific word line of said memory cell array;

a sense amplifier consisting of a plurality of differential amplifiers connected to said plurality of data lines respectively for amplifying the data read into said plurality of data lines;

first and second sense amplifier drivers connected to the opposite ends of a restore signal line and a drive signal line respectively which are in turn connected to said plurality of differential amplifiers of said sense amplifiers, and

a delay means for giving a time difference to an operation start timing of said first and second sense amplifier drivers.

‘998 Patent, Claim 1. The Court will analyze each disputed claim term in turn.

1. *“means for reading into a plurality of data lines data from a plurality of memory cells connected to a specific word line by activating said specific word line of said memory cell array”*

The first term appears in Claims 1 and 4 of the patent.⁴ The parties do not dispute that this is a means plus function claim limitation under 35 U.S.C. § 112 ¶ 6. (MEI Patents Chart at 1). Means-plus-function terms are governed by 35 U.S.C. §112, ¶ 6. This section provides that:

[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall

⁴ Although the “means for reading” claim term appearing in Claim 7 is not identical to the “means for reading” term appearing in Claims 1 and 4, the parties clarified at the *Markman* hearing that no separate issue existed, and that the Court’s construction for the “means for reading” term in Claims 1 and 4 will apply equally to Claim 7. (Tr. of *Markman* Hrg at 54:24-55:8).

be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereto.

35 U.S.C. §112, ¶ 6 (Thomson/West 2006). This statutory provision allows patentees to “claim an element of a combination functionally, without reciting structures for performing these functions.” *Apex, Inc. v. Raritan Computer, Inc.*, 325 F.3d 1364, 1371 (Fed. Cir. 2003). In exchange for the convenience of employing §112, ¶ 6, the patentee must disclose structure in the specification that is clearly linked or associated with the claimed function. *Budde v. Harley Davidson, Inc.*, 250 F.3d 1369, 1377 (Fed. Cir. 2001).

In construing a means-plus-function claim limitation, the court must engage in a two-part inquiry. *Id.* at 1376. First, the court must identify the particular function that is claimed. *Id.* Second, the court must determine the corresponding structure that performs the claimed function. *Id.* Failure to disclose adequate corresponding structure renders the claim’s scope indefinite, and therefore invalid under § 112, ¶ 2. *Id.* A finding that a claim containing a means-plus-function limitation lacks structural support must be supported by clear and convincing evidence that the specification does not disclose structure sufficient to perform the recited function. *Id.* at 1376-77. Such a determination must be made from the viewpoint of a skilled artisan. *Id.* at 1376.

In addition to agreeing that the disputed term is governed by § 112 ¶ 6, the parties further agree on the claimed function. The stipulated function is “to read data from a plurality of the memory cells connected to a specific word line into a plurality of data lines by activating the specific word line of the memory cell array.” (*Id.*). The dispute arises, however, with respect to the corresponding structure.

The parties’ disagreement stems in part from their varying interpretations of the agreed upon

claimed function. According to Samsung, the claimed function actually encompasses two separate functions, namely “reading” and “activating.” Citing *Asyst Techs., Inc. v. Empak, Inc.*, 268 F.3d 1364 (Fed. Cir. 2001), Samsung argues that the corresponding structure is the structure that is necessary to perform both of these functions. As such, Samsung argues that the corresponding structures are undisclosed structure in the word line driver 3 and the memory array 4. Samsung agrees with MEI that the word line driver 3 performs the “activating” function. (See Samsung Opp’n at 26; Tr. of *Markman Hr’g* at 13:4-6). Samsung, however, claims that some undisclosed structure within memory cell 13 of the memory array 4 is the additional structure required to perform the “reading” function. (Samsung Opp’n at 27).

MEI agrees that the word line driver 3 is corresponding structure, but disagrees that the memory array 4 is necessarily included as structure that performs the claimed function. MEI argues that the claimed function involves only one function, namely “reading . . . by activating,” as opposed to two separate functions as Samsung contends. Relying on the specification, MEI asserts that “reading” is “the result that necessarily flows from the ‘activating’ function,” (MEI’s Br. In Reply to Samsung’s Substituted Opp’n *Markman* Br. for the Matsushita Patents (“MEI Reply”) at 11), which the specification discloses is performed by the word line driver 3. As such, the word line driver is the only corresponding structure.

The Court agrees with Samsung that the claimed function entails the two separate functions of “activating” and “reading.” The Court disagrees with MEI’s position that the “reading” of data should not be construed as a separate function, but instead should be characterized as a necessary result of the “activating” function since, as stated in the specification, data is read “as a result” of a word line becoming activated. Whether it occurs as a result of another function, or is triggered by

some other factor, the act of “reading” data is nonetheless a function. As such, the corresponding structure must include that structure which is necessary to perform both functions. *Micro Chem., Inc. v. Great Plains Chem. Co.*, 194 F.3d 1250, 1257-58 (Fed. Cir. 1999).

The relevant portion of the specification provides a description of the data read-out operation in a semiconductor memory device. Referring to Figure 6 of the patent, the specification states that:

A specific word line in a memory cell array 4 in which a number of memory cells are arranged in the shape of a matrix is *activated* by the output signal of a *word line driver* 3.

As a result, *data from* a plurality of *memory cells* connected to the activated word line *is read out* via a plurality of data lines 5 into a sense amplifier 6.

‘998 Patent, col. 1, ll. 21-28 (emphases added). Based on this excerpt, it is clear that the word line driver and the memory cells which are connected to the activated word line are clearly linked to the data read-out operation. In particular, the word line drive 3 “activates” the word line and the memory cells connected to the activated word line perform the “reading” function.⁵

Samsung argues that the patent fails to describe with specificity what structures within the memory cell actually perform the “reading” function. MEI counters by arguing that the patent need not disclose the structure with specificity because the structure of a memory cell was well known to a person of ordinary skill in the art. This Court agrees. See *S3 Inc. v. NVIDIA Corp.*, 259 F.3d 1364, 1371 (Fed. Cir. 2001) (“The law is clear that patent documents need not include subject matter that

⁵ MEI further argues that the memory cell cannot be corresponding structure because the structure of a memory array is already required by the claim as set forth in the element preceding the means-plus-function limitation. MEI fails, however, to provide support for this argument. (MEI’s Br. at 25; MEI’s Reply at 12). What is clear, however, is that a court must determine all corresponding structure that performs the claimed function when analyzing a means-plus-function limitation under 35 U.S.C. § 112, ¶ 6. *Micro Chem.*, 194 F.3d at 1257-58.

is known in the field of the invention and is in the prior art, for patents are written for persons experienced in the field of the invention.”). Samsung does not present any evidence suggesting that the structure of a memory cell is not commonly understood by persons in the field. Consequently, the Court concludes that the claimed function is “to read data from a plurality of the memory cells connected to a specific word line into a plurality of data lines by activating the specific word line of the memory cell array” and the corresponding structures are the word line driver 3 and memory cells 13.

2. “sense amplifier”

The next disputed term is “sense amplifier” which appears in Claim 1. The claim recites “a sense amplifier consisting of a plurality of differential amplifiers connected to said plurality of data lines respectively for amplifying the data read into said plurality of data lines.” ‘998 Patent, Claim 1. Samsung’s proposed construction limits the “sense amplifier” to include “only differential amplifiers that sense from one memory cell array.” (MEI Patents Chart at 1). Samsung’s position is based on the “consisting of” language which appears in the claim.

Citing *Vehicular Technologies Corp. v. Titan Wheel International, Inc.*, 212 F.3d 1377 (Fed. Cir. 2000), Samsung asserts that “consisting of” is a term of art used in claim construction which signifies restriction and exclusion. Thus, Samsung argues that a sense amplifier is restricted to the claim language following the term “consisting of,” namely “a plurality of differential amplifiers connected to said plurality of data lines respectively for amplifying the data read into said plurality of data lines.” ‘998 Patent, Claim 1. Focusing on the language “said plurality of data lines,” Samsung notes that this term finds its antecedent basis in the preceding element of the claim. As such, it is Samsung’s position that because the claim requires these data lines to “only read from

memory cells on the ‘specific word line’ in the single memory array, the ‘sense amplifier’ is likewise restricted to that memory array.” (Samsung’s Opp’n at 31).

MEI, however, argues that Samsung is impermissibly attempting to incorporate limitations into the plain meaning. MEI contends that the “sense amplifier” is not limited to amplifying data from only one memory cell array. At the *Markman* hearing, MEI clarified that it agrees “consisting of” is a close-ended phrase but posits that the restriction is limited to the “plurality of differential amplifiers” and does not apply to the remaining language following that term. (Tr. of *Markman* Hrg at 26:2-13).

Based on the claim language, the Court concludes that the “sense amplifier” is not limited to amplifying data from only one memory cell array. In *Vehicular Technologies*, the Federal Circuit stated that:

The phrase “consisting of” is a term of art in patent law signifying restriction and exclusion, while, in contrast, the term “comprising” indicates an open-ended construction. In simple terms, a drafter uses the phrase “consisting of” to mean “I claim what follows and nothing else.” A drafter uses the term “comprising” to mean “I claim at least what follows and potentially more.”

Vehicular Techs., 212 F.3d at 1382-83 (citations omitted). However, these guidelines provided by the Federal Circuit cannot be neatly applied in this particular instance given the claim language chosen by the patentees. The Court agrees with Samsung that the claim uses “consisting of” with respect to a “plurality of differential amplifiers.” The claim, however, proceeds to reference “said plurality of data lines” which finds its antecedent basis in the preceding claim element – notably an element that appears before the “consisting of” language. Instead, this element follows the “comprising” language of the preamble. Thus, the patent claims, at minimum, one memory cell

array, but may potentially claim more, including additional memory cell arrays with additional data lines. The Court finds nothing in the claim language or intrinsic evidence to indicate that the differential amplifiers contained within the sense amplifier are limited to sensing from only one memory cell array. As such, the Court does not find a clear basis for importing the narrowing limitation which Samsung seeks to include. Consequently, the Court adopts MEI's construction.

3. “*sense amplifier driver*”/“*restore signal line*”/“*drive signal line*”

The Court will next construe the claim terms “sense amplifier driver,” “restore signal line,” and “drive signal line.” At the *Markman* hearing, the parties informed the Court that construction of these terms should be addressed together as they present the disputed issue as to whether the claims of the ‘998 Patent allow for a one-to-one correspondence between the sense amplifier drivers and the differential amplifiers. (Tr. of *Markman* Hr’g at 27:11-36:12, 42:16-19). Based on the parties’ arguments, this is an issue that will be dispositive of the patent’s validity at a later stage. Though this may be the case, the Court will proceed with its analysis in accordance with Federal Circuit precedent on claim construction, particularly *Phillips*, i.e., by placing primary focus on the intrinsic evidence, and without regard to invalidity arguments disguised as claim construction arguments.

The Court will first address “sense amplifier driver.” Samsung proposes that the term means “a circuit connected to the restore signal line and the drive signal line that provides voltages for operating one or more differential amplifiers.” (MEI Patents Chart at 2). MEI proposes that the term means “a circuit which provides voltages for operating the differential amplifiers. The voltages are provided through the restore signal line and the drive signal line.” (*Id.*). Based on these

constructions, the parties agree that a sense amplifier driver is a circuit that provides voltages for operating differential amplifiers. Thus, the Court will focus its analysis on the two issues arising from the remaining disputed language in the proposed constructions: 1) whether the scope of this term encompasses a sense amplifier driver providing voltage to only one differential amplifier and 2) the proper characterization of restore and drive signal lines with respect to the sense amplifier driver.

The parties have identified the first issue as the “one-to-one correspondence” issue. MEI argues that the sense amplifier driver must be connected to a plurality, i.e., two or more, differential amplifiers, which preclude a one-to-one correspondence between the sense amplifier driver and the differential amplifiers. MEI contends that Samsung’s argument must fail because it inappropriately equates “differential amplifiers” with “sense amplifiers.” (Tr. of *Markman Hr’g* at 28:1-7). In contrast, Samsung offers a number of reasons to support its position that the claim encompasses a one-to-one correspondence. Having reviewed these arguments, the Court finds them unpersuasive and concludes that a circuit encompassing a one-to-one correspondence between a sense amplifier driver and a differential amplifier falls outside of the ambit of the claims of the ‘998 Patent.

The Court will first look at the language of the claims which includes these disputed claim terms. Claim 1 provides, in part, that the semiconductor device is comprised of:

a *sense amplifier* consisting of a plurality of differential amplifiers connected to said plurality of data lines respectively for amplifying the data read into said plurality of data lines;

first and second sense amplifier drivers connected to the opposite ends of a restore signal line and a drive signal line respectively which are in turn connected to said plurality of differential amplifiers of said *sense amplifiers*

‘998 Patent, Claim 1. Claim 4, another independent claim of the patent, recites in relevant part:

a first sense amplifier consisting of a plurality of differential amplifiers connected to a specific number of data lines of said plurality of data lines respectively for amplifying data read into said specific number of data lines;

a second sense amplifier consisting of a plurality of differential amplifiers connected to remaining data lines of said plurality of data lines respectively for amplifying data read into said remaining data lines;

first and second sense amplifier drivers connected to the opposite ends of the restore signal line and drive signal line which are in turn connected in common to the differential amplifiers of said first and second sense amplifiers;

a third sense amplifier driver connected to said restore signal line and said drive signal line which are disposed between said first and second sense amplifiers . . .

Id., Claim 4. Lastly, Claim 7 which is the last independent claim of the patent requires:

sense amplifiers consisting of a plurality of differential amplifiers for amplifying data read into said plurality of data lines;

a plurality of sense amplifier drivers connected to a plurality of positions of the signal lines respectively which are in turn connected in common to said plurality of differential amplifiers . . .

Id., Claim 7. Based on the claim language, it is clear that the patentees differentiate the terms “sense amplifier” and “differential amplifiers.” Notably, in each of these claims, and as discussed above, the patentees chose to describe the sense amplifiers as “consisting of” a plurality of differential amplifiers. Claim 1 only requires one sense amplifier. Claim 4 requires two – i.e., a “first” and a “second” sense amplifier. Claim 7 requires a plurality of sense amplifiers. However, all of these claims share the same requirement that each sense amplifier consists of a plurality of differential amplifiers. Because all of the claims require at least one sense amplifier, the claims also require at

least two differential amplifiers. This eliminates the possibility of a one-to-one correspondence between a sense amplifier driver and a differential amplifier.

The specification and drawings illustrate this point. Figures 1 and 2 depict circuitry in which differential amplifiers 14-18 are contained within the sense amplifier 6. ‘998 Patent, col. 3, l. 60-col. 4, l. 64. In describing Figure 4, another embodiment of the invention, the specification provides that Figure 4 bears the same reference numbers as Figure 1. *Id.*, col. 5, ll. 14-17. The specification also provides that:

FIG. 4 differs from FIG. 1 in that there are provided two blocks, i.e. first and second sense amplifiers 36 and 37 which correspond to the sense amplifier 6 in FIG. 1, with a third sense amplifier [driver] 38 disposed between said first and second sense amplifiers 36 and 37 to connect it to the latter.

Id., col. 5, ll. 18-23. Thus, the two sense amplifiers 36 and 37 of Figure 4 likewise contain a plurality of differential amplifiers as the sense amplifier 6 of Figure 1.

Samsung fails to provide a sufficient basis to include the proposed limitation of “one or more differential amplifiers” in the construction of the term “sense amplifier driver.” First, Samsung argues that its construction relies on the plain meaning of the terms at issue. For the reason discussed above, however, the plain language of the independent claims requires the “sense amplifier” to contain more than one differential amplifier and Samsung fails to convince this Court otherwise.

Samsung also argues that MEI’s construction ignores the “comprising” language of the preamble. As previously discussed, this term means that the patentee requires at minimum the elements of the claim, and perhaps even more. Samsung mistakenly argues that this means that the “claim does not exclude additional structure” including a one-to-one “driver to amplifier.”

(Samsung's Opp'n at 16). This may be true if by amplifier Samsung is referring to "sense amplifier." But this is not the issue before the Court. Based on Samsung's proposed construction, the issue concerns the one-to-one correspondence between a sense amplifier driver and a differential amplifier which the claim does not encompass. As Samsung acknowledged, the patentees deliberately chose to claim "a sense amplifier consisting of a plurality of differential amplifiers." As such, this eliminates the possibility of a "sense amplifier" containing only one "differential amplifier." Consequently, Samsung's argument on this basis is rejected.⁶

Analysis of the second issue necessarily implicates the proper construction of the disputed terms "restore signal line" and "drive signal line."⁷ Samsung argues that "restore signal line" means "a line having a restore signal connected to one terminal (the restore terminal) of the plurality of differential amplifiers." (MEI Patents Chart at 2). MEI argues that the proper construction is "a line whose purpose is to provide a restore signal to a plurality of differential amplifiers." The parties offer comparable constructions for "drive signal line." (*Id.*).

Samsung asserts that its construction is supported by the plain meaning of the claim language, and in particular the word "connected." Samsung notes that "connected" is the only active verb contained in the claim and contends that the plain meaning of the word means "joined or linked

⁶ Samsung makes alternative arguments concerning the '095 Patent and certain expert testimony. These references are extrinsic evidence. As such, the Court will attribute no weight to these references in light of the clear guidance provided by the intrinsic evidence, namely the claim language and specification.

⁷ The parties stipulated that "restore signal" means "a signal that causes one of the two data lines connected to a differential amplifier to go high when sensing data from a memory cell" and "drive signal" means "a signal that causes one of the two data lines connected to a differential amplifier to go low when sensing data from a memory cell." (MEI Patents Chart at 2).

together.” (Samsung Opp’n at 15). According to Samsung, the claim does not include any verbs describing the “purpose” of the line and MEI provides no basis for including such limitation in the claim construction. Samsung argues that Federal Circuit case law prohibits importing the purported “purpose” of the signal lines in the claim construction.

MEI counters by arguing that its construction does take into account the term “connected” by acknowledging that voltages are provided from the sense amplifier driver to the differential amplifiers through the restore and drive line signals which are connected to both. MEI further argues that Samsung’s use of the term “having” in its construction is vague and therefore should be rejected.

The Court, however, finds that the claim language and specification provide a clear meaning for the terms “restore signal line” and “drive signal line.” The relevant claim language provides that sense amplifier drivers are “connected to the opposite ends of a restore signal line and a drive signal line respectively which are in turn connected to said plurality of differential amplifiers of said sense amplifiers.” ‘998 Patent, Claim 1. Thus, based on the claim language alone, it is clear that the restore and drive signal lines are physically connected to both the sense amplifier drivers and to the plurality of differential amplifiers contained within the sense amplifiers.

The Court next looks to the specification. The specification describes the restore signal line and the drive signal line as follows:

First, when data from a memory cell 13 is sensed by data lines 5-1-5-5, there will arise slight potential differences between the signal lines of each pair of data lines 5-1-5-5. Then, drive signals are applied to the input terminals 23 and 24 of the first sense amplifier driver 7 so as to make the transistors 21 and 22 of the sense amplifier driver 7 conduct. Consequently, *electric current flows in the restore signal line 19 and the drive signal line 20*, and thus, the *differential amplifiers 14-18 start to operate*. The operation as described above is same as in the prior art.

‘998 Patent, col. 4, ll. 14-24. The specification teaches that in addition to being connected to the sense amplifier drivers and the differential amplifiers, electric current flows through the restore signal line and drive signal line which causes the differential amplifiers to begin operation. Thus, in light of the plain language of the claim and the specification, the Court concludes that “restore signal line” means “a line that is connected to both the sense amplifier driver and the differential amplifier through which an electric current, namely a restore signal, flows which causes the differential amplifiers to operate.” The Court finds that this construction adequately describes the “restore signal line” and finds no basis for importing the specific limitation of “purpose” – a term that is absent in both the claim language and specification. (Tr. of *Markman* Hr’g at 49:14-18). Similarly, “drive signal line” means “a line that is connected to both the sense amplifier driver and the differential amplifier through which an electric current, namely a drive signal, flows which causes the differential amplifiers to operate.”

Returning to the first issue presented with respect to the construction of “sense amplifier driver,” the Court concludes that MEI’s proposed definition more closely reflects the Court’s conclusion regarding the restore and drive signal lines. Thus, the Court will adopt a slightly modified construction. Accordingly, “sense amplifier driver” means “a circuit that is connected to a restore signal line and a drive signal line which provides voltages for operating the differential amplifiers.”

4. *“opposite ends”*

The next dispute concerns the claim term “opposite ends” which appears in Claims 1 and 4 of the patent. Claim 1 requires the first and second sense amplifier drivers to be connected to the “opposite ends” of a restore signal line and a drive signal line. ‘998 Patent, Claim 1. MEI proposes

that the sense amplifier drivers are on “opposite ends” of the restore and drive signal lines “with respect to groupings of differential amplifiers.” (MEI Br. at 30). Relying on the specification, MEI argues that the patent teaches a reduction in wiring resistances when sense amplifier drivers provide signals from opposite ends of a grouping of differential amplifiers, and not necessarily the opposite ends of the restore and drive signal lines. As such, “opposite ends” should be construed as opposite “with respect to a plurality of differential amplifiers.” (*Id.* at 32).

Samsung counters by arguing that the term “opposite ends” unambiguously references the restore and drive signal lines, and not the differential amplifiers. Thus, Samsung offers the proposed construction for “opposite ends” as “towards the termination points of conductor [i.e. restore/drive signal] lines.” (Samsung Opp’n at 32). Samsung contends that its construction is based on the “heavy presumption” that the term should be construed based on its ordinary meaning and the plain language of the claim. Samsung also maintains that the intrinsic evidence supports this construction.

Based on the claim language, the Court agrees with Samsung that the term “opposite ends” refers to the “opposite ends” of the restore and drive signal lines and does not refer to the grouping of differential amplifiers. Mindful of the bedrock principal that “the claims of a patent define the invention to which the patentee is entitled the right to exclude,” *Phillips*, 415 F.3d at 1312 (citing *Innova/Pure Water*, 381 F.3d at 1115), a review of the ‘998 Patent’s independent claims leads to this conclusion. The Court first notes that the term “opposite ends” is used in an identical manner in Claims 1 and 4. Notably, Claim 7 does not reference the term “opposite ends.” In both Claims 1 and 4, the claim requires a first and second sense amplifier driver to be located at opposite ends of the signal lines. Claim 4 specifically requires:

first and second sense amplifier drivers connected to the opposite ends of the restore signal line and drive signal line which are in turn connected in common to the differential amplifiers of said *first and second sense amplifiers*

Id., Claim 4. As discussed extensively above, each sense amplifier consists of a plurality of differential amplifiers. As such, in this particular claim there are at least two separate groups of differential amplifiers belonging to a first and a second sense amplifier. Moreover, Claim 4 requires a third sense amplifier driver to be located at some point between the first and second sense amplifiers. Specifically, the claim requires:

a third sense amplifier driver connected to said restore signal line and said drive signal line which are disposed between said first and second sense amplifiers

Id., Claim 4. The Court concludes that this language belies MEI's argument that the "opposite ends" are in reference to the opposite ends of a group of differential amplifiers. If MEI's construction were applied to Claim 4, it would be unclear as to whether the first and second sense amplifier drivers were positioned at the opposite ends of the first group of differential amplifiers, i.e., those belonging to the first sense amplifier, or the second group of differential amplifiers belonging to the second sense amplifier – since this claim necessarily includes a third sense amplifier driver separating these two groups. The more reasonable construction is that the first and second sense amplifier drivers in both Claims 1 and 4 are positioned at the opposite ends of the restore and drive signal lines, i.e., towards the termination points of the signal lines, which would allow the third sense amplifier driver to be positioned in between the two.

The language of Claim 7 further supports the Court's construction. Although Claim 7 contains similar limitations as those found in Claims 1 and 4, the term "opposite ends of a restore

signal line and a drive signal line" is not present. If MEI's construction were correct, one would expect the claim to retain the term "opposite ends" even without the accompanying phrase "restore signal line" and "drive signal line" since the claim refers to a plurality of differential amplifiers. But it does not which further supports the conclusion that the "opposite ends" in Claims 1 and 4 refer to the ends of the restore and drive signal lines.

The Court also rejects MEI's assertion that the specification supports its construction. First, MEI points to the specification which reads:

FIG. 1 is different from FIG. 6 only in that the sense amplifier 6 has one end connected to a first sense amplifier driver 7, and has its other end connected to a second amplifier driver 29.

A p-type field effect transistor 30 and an n-type field effect transistor 31 are connected to the other end of the sense amplifier 6, i.e. the other end of a restore signal line 19 and the other end of a drive signal line 20 respectively, said transistors 30 and 31 constituting a second sense amplifier driver 29.

Id., col. 3, ll. 61-64, col. 4, ll. 1-7. However, this part of the specification is describing an embodiment with one grouping of differential amplifiers positioned in between a first and second sense amplifier driver. Thus, although the specification describes sense amplifier drivers positioned at the opposite ends of a plurality of differential amplifiers, the specification also describes them equally positioned at opposite ends of the restore and drive signal lines. Therefore, the Court finds no basis in this disclosure of the patent to conclude that the "opposite ends" means with respect to the group of differential amplifiers, and not to the signal lines.

Second, MEI refers to the specification describing Figures 4 and 5 of the Patent.

Such an arrangement ensures that the opposite ends of the first sense amplifier 36 will be driven by means of the first and second sense amplifier drivers 7 and 38 and that the second sense amplifier 37 will

be driven by means of the third and second sense amplifier drivers 38 and 29.

Id., col. 5, ll. 34-39. The Court disagrees with MEI that this language supports its construction. Instead, this language shows that the patentees used the term “opposite ends” consistently in the patent. In this instance, however, “opposite ends” is used to modify the “first sense amplifier 36,” as opposed to a “restore signal line and a drive signal line” as Claims 1 and 4 require. Specifically, referring to Figure 5, the patentees state that the opposite ends of the first sense amplifier 36 will receive drive signals from sense amplifier driver 7 and 38, which according to Figure 5 are located toward the termination points of sense amplifier 36. Consequently, having rejected MEI’s proposed construction, the Court adopts Samsung’s construction that “opposite ends” means “toward the termination point of the conductor lines.”

B. The ‘095 Patent

The ‘095 Patent is entitled “Semiconductor Memory Apparatus With Reduced Line Widths.” The patent was issued on December 20, 1994 to Yamada *et al.* The ‘095 Patent seeks to address problems that existed in the prior art as the need for greater memory and high speed operation for DRAM increased. As discussed above, increasing the memory capacity in DRAM required the integration of additional memory cells. To maintain chip size, however, the width of connecting lines in the chip needed to be reduced. A consequence of using narrower wires in a DRAM was greater wiring resistance. This led to the delay in amplification of electrical signals from the bit line and the overall delay in the operational speed of the DRAM chip.

The inventors of the ‘095 Patent attempted to solve this problem by reorganizing the spatial

arrangement of the DRAM chip components. Rather than positioning sense amplifier drive circuits along the periphery of a memory cell array, the patent teaches distributing the sense amplifier drive circuits throughout a region containing memory cells and sense amplifier circuits. The inventors recognized that “a sense amplifier circuit that is located close to the switches that connect the bit line pair to the power supply voltages will exhibit a relatively low amount of amplification delay.” ‘095 Patent, col. 1, ll. 45-48. The patent further teaches using power supply meshes with the memory array region to provide sufficient drive current for operation. This arrangement places the sense amplifier drive circuits closer to the power supply voltages. The invention also eliminates the need for long thin wires to provide power to the sense amplifier drive circuits. See ‘095 Patent, col. 8, ll. 26-28, col. 10, ll. 17-24, col. 12, ll. 49-57, col. 14, ll. 50-62.

1. *“distributed”*

The ‘095 Patent presents two main disputed claim construction issues. The first concerns the arrangement of the elements of Claim 1 based on the claim terms “distributed through” and “distributed among.” Independent Claim 1 recites:

A semiconductor memory apparatus including a memory array region having formed therein:

a plurality of unit memory cell blocks *distributed through* said memory array region at regular spacings, each formed of an array of memory cells;

a plurality of unit sense amplifier blocks *distributed among* said unit memory cell blocks at regular spacings, each formed of an array of sense amplifier circuits;

a plurality of sense amplifier drive circuits for driving said sense amplifier circuits, *distributed among* said unit sense amplifier blocks at regular spacings; and

first and second voltage supply meshes, mutually electrically isolated and each extending throughout said memory array region, respectively coupled to receive first and second supply voltages;

each of said sense amplifier drive circuits being coupled to an adjacent point on said first voltage supply mesh to receive said first supply voltage and to an adjacent point on said second voltage supply mesh to receive said second supply voltage.

'095 Patent, Claim 1. MEI argues that Claim 1 requires the first three elements of the claim, namely the unit memory cell blocks, the unit sense amplifier blocks, and the sense amplifier drive circuits, to be arranged "throughout the power grid in two dimensions of the memory array region." (MEI Br. at 42). Samsung, however, contends there is no requirement that the distribution must be in two dimensions. Instead, the distribution must be "in at least one direction." (MEI Patents Chart at 10).

A review of the intrinsic evidence supports Samsung's construction. Beginning its analysis with the claim language, the Court notes that the plain language of Claim 1 does not include any language suggesting that the unit memory cell blocks, the unit sense amplifier blocks, and the sense amplifier drive circuits must be arranged in a two-dimensional distribution. Rather, the claim requires the three elements to be distributed "at regular spacings" throughout the memory array region. The Court agrees with Samsung that this can be achieved with a one-dimensional arrangement.

MEI argues that the fourth element of the claim concerning the first and second voltage supply meshes indicate that two-dimensions are required. MEI asserts that because the sense amplifier drive circuits must be "coupled to an adjacent point" on the first and second voltages supply meshes, which the parties agree are a two-dimensional arrangement of conductors, (MEI Patents Chart at 11), the sense amplifier drive circuits must also be in a two-dimensional

arrangement. (MEI's Br. at 42). The Court disagrees that the claim language warrants such a conclusion. Although the claim may require two-dimensional power supply meshes, the sense amplifier drive circuits may nonetheless be coupled to adjacent points of the meshes if they were arranged in a one-dimensional distribution.

Samsung argues that the patentees in Claim 6 claimed a spatial arrangement in two directions, i.e., along columns and rows, which establishes that a two-dimensional arrangement was not claimed in Claim 1. Claim 6 reads:

*said plurality of unit memory cell blocks are configured as a *plurality of columns* of unit memory cell blocks each extending in a *first direction*, each column consisting of a *plurality of said unit memory cell blocks disposed at regular spacings**

‘095 Patent, Claim 6. MEI counters by arguing that Claim 6 covers other elements in addition to the two-dimensional arrangement, such as word lines formed in an upper and lower layer, and therefore cannot be a basis for concluding that the patentees did not claim a two-directional arrangement in Claim 1.

The Court finds Samsung's argument to be more persuasive. Although the claim may include additional elements, Claim 6 expressly requires the unit memory cell blocks to be arranged in a plurality of columns, i.e., two or more columns. The claim further specifies that each column contains two or more unit memory cell blocks. This establishes an arrangement in two dimensions – specifically, columns of memory cell blocks distributed at regular spacings in one direction, and multiple memory cell blocks distributed within each column at regular spacings in a second direction. As the Federal Circuit noted in *Phillips*, “the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the

independent claim.” *Phillips*, 415 F.3d at 1315. The Court finds this to be the case here.

Turning to the specification, MEI argues that the purpose of the invention was to improve the performance of memory arrays by placing “sense amplifier drive circuits closer to the mesh source of the power, so that the resistances of the lines providing power to the sense amplifier drive circuits are substantially reduced.” (MEI Br. at 43). MEI claims that “[o]nly the grid arrangement of sense amplifier drive circuits connected at adjacent points to the meshes would accomplish this purpose.” (*Id.*). MEI posits that sense amplifier blocks and unit memory cells must also be arranged in two dimensions to achieve the purpose of the invention.

The Court disagrees with MEI’s position. The specification describes the invention as an improvement over the prior art by distributing sense amplifier drive circuits throughout a memory array region, rather than only at the periphery as they were in the prior art. In describing the problems in the prior art, the patent discloses that:

The basic cause of delay in . . . amplification by the sense amplifier circuits is the time required to charge the bit line pair capacitance, through pairs of sense amplifier drive lines (each coupled in common to a large number of sense amplifier circuits) that are peripherally connected to power supply voltages after a data read operation is initiated. The rate of charging of the bit line pair capacitance of a sense amplifier circuit depends upon the position of the sense amplifier circuit along such a pair of sense amplifier drive lines, i.e. a *sense amplifier circuit that is located close to the switches* that connect the bit line pair to the power supply voltages will exhibit a relatively *low amount* of amplification delay, whereas a *sense amplifier circuit that is located substantially distant* from these switches will exhibit a *substantial amount* of amplification delay.

‘095 Patent, col. 1, ll. 35-51. Thus, the patent teaches that a sense amplifier circuit’s position in relation to the power supply voltages (the voltages in this case being V_{ss} and V_{dd}) largely dictates the amplification delay. The patent further teaches that using power supply meshes to provide voltages

to sense amplifier drive circuits that are distributed throughout the memory array region reduces the delay. *Id.*, col. 1, l. 63-col. 2, l. 12. The specification does not state that delay may be reduced only if the various circuitry are configured in a two-dimensional arrangement, as MEI contends.

The patent specification further discloses that the power supply meshes and the sense amplifier drive circuits are dispersed throughout the memory array region, as opposed to being located at the periphery. *Id.*, col. 8, ll. 17-25. This allows each of the sense amplifier drive circuits to be connected to the nearest points on the power supply meshes to receive the V_{ss} and V_{dd} supply voltages. *Id.* The specification further provides that this arrangement reduces the path length between each sense amplifier drive circuit and the power supply meshes, as well as the distance between the sense amplifier circuits and the sense amplifier drive circuits. *Id.*, col. 8, ll. 26-33. Moreover, the specification discloses that the sense amplifier drive circuits drive “a smaller number of sense amplifier circuits than is possible in a prior art semiconductor memory apparatus, in which sense amplifier drive circuits are not distributed throughout the memory cell array.” *Id.*, col. 8, ll. 33-38.

The Court concludes that all of these inventive features may be accomplished by an arrangement that extends in one direction, such as the illustration shown in Figure 5B. Although MEI accurately notes that this figure is merely a “cut-out of Figure 5A,” (Tr. of *Markman* Hr’g at 79:13), it nonetheless depicts an arrangement that incorporates two power supply meshes in two dimensions, as well as a plurality of sense amplifier drive circuits 103 dispersed throughout the memory array region rather than along the periphery of the memory array, a plurality of unit memory

cell blocks 102, and sense amplifier circuits 108 which all extend in one direction.⁸ Notably in this configuration, the length of the paths between the sense amplifier drive circuit and the power source of the V_{ss} and V_{dd} voltages, as well as the path between the sense amplifier circuits and the sense amplifier drive circuits, are reduced in comparison to the prior art DRAM arrangement as depicted in Figure 1A. As such, the Court finds no basis in the specification that warrants inclusion of the “two-dimension” limitation in the claim construction.

The prosecution history further supports the Court’s construction. MEI claims that the arrangement of a “two-dimensional power grid with an arrangement of unit memory cell blocks each having adjacent unit sense amplifier blocks and sense amplifier drive circuits distributed through the grid” was repeatedly emphasized as one of the novel features during prosecution. (MEI Br. at 44). The Court finds, however, that the patentees emphasized the novelty of the two-dimensional power supply mesh and its role in allowing each sense amplifier circuit to be connected to a power supply voltage source at a position adjacent to the sense amplifier circuit during prosecution. Specifically, the patentees argued:

It is clear that [the problem of varying amounts of sensing delay time for the bit line pairs] results from the fact that it is necessary in the prior art to connect each drive line pair to (effectively) the supply voltage source at the periphery of the chip. However with the present invention that limitation is removed. By forming a 2-dimensional low-impedance power supply mesh that extends throughout the sense

⁸ MEI urges the Court to focus on Figure 5A, rather than on the incomplete illustration of Figure 5B, which purportedly demonstrates that the claim requires two-dimensional distribution. (Tr. of *Markman* Hr’g at 79:13). Although the figure does indeed illustrate a two-dimensional arrangement, the Court notes that Figure 5A merely represents one embodiment of the invention. ‘095 Patent, col. 3, ll. 1-3. It is well-established that “claims are construed in light of the specification, and are not limited to a designated ‘preferred embodiment’ unless that embodiment is in fact the entire invention presented by the patentee.” *Vulcan Eng’g Co., Inc. v. Fata Aluminum, Inc.*, 278 F.3d 1366, 1376 (Fed. Cir. 2002).

amplifier region of the integrated circuit, it is arranged that each sense amplifier circuit can be connected (through respective switches) to that supply mesh at a position adjacent to the sense amplifier circuit. Thus, each sense amplifier circuit can be directly connected via a low-impedance path to the power supply voltage source, and so the respective rates of charging of the various bit line pairs can be made substantially identical.

(Aug. 30, 1993 Amendment at 3). Notably, the patentees did not emphasize that the sense amplifier circuits, memory cell blocks or sense amplifier drivers must be configured in a two-dimensional arrangement as well. Rather, the focus remained on the low-impedance path provided by power supply meshes to the power supply voltage source.

The patentees continued to exalt the benefits provided by the power supply meshes by providing an example concerning a prior art chip and a chip embodying the present invention.

It must be emphasized that the impedance of one of the drive lines 7, 8 in the prior art circuit of Fig. 1A, as measured between any specific position within the integrated circuit and the periphery of the chip, will be very much greater than the impedance of the power supply grid, measured between a similar position within an integrated circuit of the present invention and the periphery of the chip. That will be true even if the length and cross-sectional area of each conductor constituting a prior art drive line are identical to those of each conductor constituting the supply voltage mesh of the present invention, and is due to the fact that the vertical and horizontal conductors of the mesh are periodically interconnected (by though-hole connections) as shown in the drawings. That is the essential basis of the invention.

(*Id.* at 3-4). Essentially, the patentees compared structurally equivalent chips, one representing the prior art and the other representing the claimed invention, and described the difference in the degree of impedance in the drive signal lines between identical positions within the integrated circuit and the periphery of the chip. Noting that the impedance would be much lower in the claimed invention, the patentees attributed the lower impedance to the presence of a two-dimensional power supply